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TWO MORE PARTS OF REVISED NATIONAL ELECTRICAL SAFETY CODE NOW READY

Two new handbooks, Nos. 8 and 9, of the Bureau of Standards have just been issued. They form part of the latest revision of the National Electrical Safety Code, which is being issued in separate parts and will later be printed in combined form.

Handbook 8 is made up of safety rules for the operation of electrical equipment and lines, and will, of course, be found of special interest to electric light and power companies and to those engaged in work around electrical machinery and lines. Rules are given for employees doing general and specialized work in electrical supply stations and on supply and communication systems. Copies of this handbook may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents each.

Handbook No. 9 contains safety rules governing radio installations. It will be found of value to owners and operators of transmitting stations and to the general public, because it contains many valuable rules for the installation of receiving equipment. Among these may be mentioned the following:

Antenna supports must be sufficiently rigid and of such size as to withstand any load which may come on them. Attachment to chimneys should be avoided. Metal poles or masts extending more than 10 feet above the supporting building must be permanently and effectively grounded.

Locations involving crossings over railroads, supply lines, etc., should be avoided, but where no other location is possible special rules are given for the installation.

In the case of receiving stations, lead-in conductors shall be not less than No. 14 A. W. G. (0.064 inch) in diameter, if of copper, nor less than No. 17 A. W. G. (0.045 inch) if made of bronze or copper-covered steel. Clearances are given between lead-in wires and other conductors on the building and it is recommended that lead-in conductors be "securely fastened in a workmanlike manner." The code also requires that the lead-in wire shall enter the building "through a rigid, noncombustible, nonabsorptive, insulating tube or bushing, or through a drilled window pane."

For receiving stations, grounds must not be made to gas pipes, but should be made to cold-water pipes, if these are connected to a street main. An outlet pipe from a water tank fed by a street main or a well may be used, provided such outlet pipe is adequately bonded to the inlet pipe connected to the street main or well. Where the wire is attached suitable clamps must be used, and the entire surface of the pipe covered by the clamp must be scraped clean.

Rules for the application of protective devices, such as lightning arresters, and antenna grounding switch are also given. Each lead-in conductor for a receiving station must be provided with a lightning arrester, whether or not an antenna grounding switch is used. The arrester may be either outside the building or inside, if away from combustible materials.

If a receiving set is connected to a power supply line, the device used and methods of wiring must be in accordance

with the rules covering permanent or portable fixtures, devices, and appliances as given in section 37 of the National Electrical Safety Code. The wiring of storage batteries must also conform to these rules, and such batteries must be placed where there is adequate ventilation.

Copies of Handbook No. 9 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

BIBLIOGRAPHY ON RADIO WAVE PHENOMENA AND MEASUREMENT OF RADIO FIELD INTENSITIES

The bureau has just issued Letter Circular No. 207, Bibliography on Radio Wave Phenomena and Measurement of Radio Field Intensities. The references in this list include the important papers on these subjects from early years to the present. It is expected that persons using this bibliography will notify the bureau of any corrections or desirable additions so that a revised edition may be issued. Copies may be obtained by persons having actual use for them upon application to the Bureau of Standards, Washington, D. C.

ESTABLISHMENT OF RADIO STANDARDS OF FREQUENCY BY THE USE OF A HARMONIC AMPLIFIER

Scientific Paper No. 530 describes a method used by the bureau in establishing radio standards of frequency. It consists in the "stepping up" from a known low frequency to a radio-frequency by the use of harmonics. The known low frequency used as a fundamental is a 1,025-cycle tuning fork driven by an electron tube. The low-frequency output from the tuning fork is carried through an amplifier which distorts it and produces harmonics. Any desired harmonic may be selected by tuning the amplifier to its frequency. This harmonic is then amplified to sufficient power to operate the frequency meter (wave meter) under standardization. By selecting different harmonics of the tuning fork the entire range of a frequency meter from about 10 to 4,000 kilocycles (30,000 to 75 meters) may be obtained from one tuning fork of known frequency. Any fixed frequency generator, such as a piezo oscillator, may be standardized by the use of the harmonic amplifier with an auxiliary device for determining the frequency of the audible beat note between a harmonic from the known tuning-fork frequency and the unknown piezo-oscillator frequency.

The auxiliary device used in determining the beat-note frequency between a harmonic of the amplifier and unknown source is a sonometer. It consists of steel piano wire mounted across two movable knife edges with a known tension applied. The frequency at which the wire will vibrate may be computed from its mass, tension, and length. The beat-note frequency is applied to the wire through a telephone receiver. The wire vibrates when its frequency is equal to the frequency of the applied beat-note frequency due to the attraction of the wire by the telephone magnet. Thus the frequency of the beat note may be obtained by computing the vibration frequency of the wire.

Two audio-frequencies may be compared very accurately by the use of the harmonic amplifier and sonometer

The paper may be obtained for 10 cents a copy from the Superintendent of Documents, Government Printing Office, Washington, D. C.

ELECTRIC TELEMETER

Various applications continue to be found for the electric telemeter (carbon pile strain gauge) described some time ago in Technologic Paper No. 247. A large number of these instruments have been embedded in the experimental arch dam constructed by the Engineering Foundation at Stevensons Creek, Calif., and are being used for the measurement of stresses in the structure of the dam. One hundred and ten telemeter cartridges for the same purpose have been purchased by two large utility companies for use in dams which they have under construction.

Other recent applications of the telemeter include measurements of the strains

in the hoisting cable of a coal mine. This investigation was carried out at the request of officials of the University of West Virginia, and good records were obtained during the acceleration and slowing down of a loaded cage weighing 21,000 pounds in a shaft 550 feet deep. These measurements were made with a gauge length of 4 inches on the cable. The possibility of making measurements with small-gauge lengths makes the telemeter available for detailed analysis of stresses, which are often much more significant than over-all stresses, such as can be measured with longer gauges. For example, detailed studies of secondary stresses are now being considered by the Committee on Welded Rail Joints of the American Electric Railway Association and by manufacturers of truck frames for freight cars in which some failures have occurred because of such stresses. For the latter purpose it is proposed to use a telemeter having a gauge length of 1 inch or less.

Technologic Paper No. 247 is available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents per copy. The bureau will be glad to furnish further information regarding possible applications to those who may have use for these instruments.

THERMAL EXPANSION OF GRAPHITE

An investigation on the thermal expansion of longitudinal and transverse samples of artificial graphite (containing 99.2 to 99.7 per cent carbon) over various temperature ranges between room temperature and 600° C. has been completed. The coefficients of expansion of graphite are low. For example, the coefficient of expansion of ordinary steel is about six times the coefficient of longitudinal graphite and about four times the value for transverse graphite between 20 and 100° C. The transverse samples expand considerably more than the longitudinal samples (approximately 45 per cent). For the longitudinal or transverse samples the coefficients of expansion decrease slightly as the purity increases.

The small expansion of graphite is an important factor in the resistance of graphite to sudden temperature changes. Plunging samples at 600° C. into cold water did not cause breakage or cracking.

Artificial graphite finds wide applications in the industries. It is used very largely for electrodes of electric furnaces, for anodes of electrolytic cells, for the making of molds for casting metals and glass, for electrical heating elements of various sorts, for electrical contacts and arcing tips, etc. In granular or powdered form, artificial graphite is used in large quantities in the manufacture of dry cells, radio batteries, and also for paint pigment, mold wash, lubricants, resistors, powder glazing, and electrotyping.

SMALL CHANGE IN CASTING OF RADIANT HEATER PRODUCES CARBON MONOXIDE

In connection with the testing of a radiant heater for completeness of combustion a most interesting result was obtained. About 18 months ago a certain appliance was tested and found to give excellent results. A year later the manufacturer changed the form of the burner, leaving unchanged, however, what were believed to be the essential dimensions, except the drilling, which was changed to make complete combustion even more certain. A sample of this burner produced carbon monoxide under normal service conditions. After much study and the trial of numerous burners drilled in various ways it was found that the essential difference was a change in the casting of the new model, probably accidental, which brought the radiant forward with respect to the burner about 1.5 mm. A burner of the new model was machined to correct this displacement and subsequently reproduced accurately the performance curves of the original burner. The striking fact is that two burners differing only in the position of the seemingly unimportant radiant support, and in that respect so little that the difference is not apparent except upon the closest examination or accurate measurement, can give totally different results

in practice. In assembled appliances, whether the gas was burning or not, no one would be able to distinguish between the two burners.

Since this small difference in construction was found to be of so much importance, tests of another appliance made during the month are of special interest. This appliance, another radiant heater, had been purchased from the stock of a local dealer and had been in service for two years. It was therefore gratifying to find that this appliance duplicated accurately the performance of a new appliance of the same model submitted by the manufacturer about three years ago.

VISUAL SENSE IN THE DISCRIMINATION OF COLOR

The experiments of the past summer have led to a new appreciation of the visual sense in the discrimination of color. One could well have believed from previous information that the dominant wave lengths of two yellows might differ by as much as 1 or 2 millimicrons without there being more than a just perceptible difference between them, and one-half millimicron was thought to be the minimum value of the "least perceptible difference." This latter value is not far from correct if we mean the least difference perceptible with certainty. However, actual experiment has shown that smaller differences have a real effect on the observer. He discerns them vaguely even if he is uncertain as to their reality. For example, 17 observers were asked to judge the difference in color of two yellow glasses having a difference in dominant wave length of only 0.2 millimicron. This difference is so slight that all hesitated to make a positive decision. However, when urged to make some choice, even if uncertain, the judgments of 13 were correct in regard to the direction of the difference; that is, they decided correctly which was the "greener" and which the "redder" of the two yellows. Three observers were unable to make any choice at all and 1 out of the 17 reversed the decision of the majority. It is thus clear that a difference of 0.2 millimicron in wave length arouses, at any rate, a strong suspicion of color difference. Doubtless, with experience, observers would learn to discern such differences with little or no chance for error. While it has been somewhat surprising to find that the color sense had this fine power of discrimination, it is more important to note that this vanishingly small difference in the color of these glasses may be determined without any ambiguity by measurements of the spectral transmission of these glasses. In other words, with the aid of the spectrophotometer, the eye can quite outdo its own notable performance in distinguishing between these glasses which are so nearly alike in color.

A METHOD TO DISTINGUISH VISCOSE FROM CUPRAMMONIUM RAYON

Rayon, the manufactured fiber which is gaining such a prominent place in the textile field, is actually produced by one of four different processes. How to distinguish the product of each of these processes, although of little importance to the ultimate consumer, is a primary consideration with the textile manufacturer. The properties, especially three of these types, are essentially the same, but the little differences may cause the manufacturer a great deal of trouble in handling, dyeing, etc.

Conclusive tests for the acetate and nitrocellulose types are fairly well established and are proving to be entirely satisfactory. The acetate type is soluble in acetic acid and in acetone; this is not true of the regenerated rayons—nitrocellulose, viscose, and cuprammonium. The nitrocellulose type may be identified by the distinctive dark-blue color to which it changes when treated with a sulphuric-acid solution of diphenylamine.

A simple and satisfactory test that will differentiate between viscose and cuprammonium types has not as yet been generally accepted or approved by the rayon industry. A positive test to differentiate between viscose and cuprammonium requiring a minimum of technique and of time has been developed. This test is outlined as follows:

Subject 5 g of the unknown sample of rayon (viscose or cuprammonium) to the action of 100 cc of water plus 3 cc glacial acetic acid for a period of four hours in a diaphragm flask. The diaphragm consists of a filter paper, which has been saturated with 10 per cent solution of lead acetate, securely fastened on the flange of the flask. If at the end of the four-hour period the exposed part of the lead acetate filter paper covering the flask becomes stained with a brown or a black color, the rayon in question is viscose rayon; if no coloration is obtained, the sample is cuprammonium.

If for any reason this single test seems insufficient, verify the results by following the above treatment with the addition of 3 cc of concentrated sulphuric acid to the flask containing the sample of rayon, fitting fresh lead acetate filter paper in place and heating the flask for another four hours on a steam bath. In this case a coloration or darkened lead acetate paper will be conclusive evidence that the sample is viscose rayon. If the sample is cuprammonium rayon there will be no coloration on the lead acetate paper.

LEATHER FROM RABBIT SKINS

Frequent inquiries have been received for information on the quality and uses of leather made from rabbit skins. The following observations summarize the bureau's data on this subject.

Various lots of leather have been examined which were tanned from skins of Australian and domestic rabbits. The first characteristic, which appears to be typical of all samples, is the presence of numerous surface defects. These defects occur in the form of grain damages, soft spots, small holes, cuts, healed sores, and scratches. This situation alone appears to make any extended use of the leather impracticable except possibly in the manufacture of very cheap novelty goods. Some portion of the skins could be selected, dyed, and given a glazed, suede, or embossed finish.

The leather varies in thickness from 0.020 to 0.125 inch, depending on the size and breed of the rabbit. The area varies from 1 to 2 square feet. The small size of the skins suggests that there would be considerable waste in cutting, which does not exist with the larger leather units. This is because of the increased practice of splitting the grain thickness from cow or steer hides. These grain leathers may vary from 30 to 60 square feet in area, and thus the waste due to cutting is minimized. In general, the tensile strength of rabbit-skin leather is very low. The results obtained varied from 800 to 2,000 lbs./in.^{2} as compared with a minimum of 3,500 lbs./in.^{2} for most calf and side leathers. A recent lot of chrome tanned, well oiled, and fairly heavy samples of rabbit leather had a strength of 3,670 lbs./in.^{2}. This leather had fewer surface defects than most examined and appeared quite suitable for use in the manufacture of some types of gloves. Most skins tear as readily as heavy paper, while the heavy skins show a tearing strength of not more than 5 pounds, as compared with from 10 to 15 for calf and side leathers. The low tearing strength might make the leather unsuitable for use in gloves, where so much stitching is required.

In general, it appears that the properties of rabbit-skin leather are such as to give it a low quality rating. Certainly it does not possess any inherent advantageous property, characteristic of such special leathers as shark and cordovan, which might be used as a basis for establishing a business in this commodity.

STANDARD SIZE FOR GARDEN HOSE

Garden hose is made in several sizes, ranging from ½ to 1 inch, inside diameter. In recent years there has been a strong tendency on the part of manufacturers to encourage the use of ⅝-inch hose in place of the ½ and ¾ inch sizes. This standardization of size seems desirable for several reasons. It would tend to reduce the cost of manufacture by eliminating two unnecessary sizes, and at the same time it would reduce the amount of stock to be carried by dealers.

That the ⅝-inch size is large enough for ordinary purposes has been demon-

strated by tests recently made at the bureau to determine the discharge capacities of ½, ⅝, and ¾ inch hose under different pressures. It was found that the discharge capacity of ⅝-inch hose is only slightly less than that of ¾-inch hose, and that it is considerably greater than that of ½-inch hose. The detailed results of these tests, together with general information relative to the selection, use, and care of garden hose, will appear in a forthcoming circular of the bureau.

MEETING OF PAPER-TESTING COMMITTEE

A meeting of the Paper-Testing Committee of the Technical Association of the Pulp and Paper Industry was held at the bureau on September 17. This committee is developing official association paper-testing methods. Methods are developed and formulated by the committee and proposed to the association for a vote as to their adoption by its entire membership. The 9 methods so far proposed by the committee have been adopted as official by the association, and 12 additional methods have been practically completed by the committee and will be proposed to the association shortly.

At this meeting suggestions respecting the 12 methods under consideration were reviewed and acted upon. Plans were also made for the further work. The committee has hitherto been working on methods that had been outlined by previous association paper-testing committees and published several years previous by the association. Therefore, they were regarded as tentative methods and the present committee simply rewrote them in more definitely detailed form for immediate adoption as official methods. In view of the fact that the further methods to be considered have not been published by the association and are not in general use, it was decided that these should be proposed for adoption by the association as tentative official methods to be considered at the expiration of one year for adoption as official methods. Subcommittees were appointed by the chairman to conduct the required development research on the methods decided upon for immediate development.

After the meeting all the visitors took advantage of the opportunity to witness demonstrations of the bureau's research on development of paper-testing methods. This included exhibition of several testing devices developed at the bureau.

PRACTICAL SUGGESTIONS REGARDING THE USE OF WATER GLASS IN THE CASTING OF CLAY WARE

The potter's handwheel, which for centuries has been used in the manufacture of pottery, is being rapidly supplanted in many plants by the casting process in which a slip, or thin water-clay mixture, is poured into molds and allowed to set. This is particularly true of the more complex or intricate shapes. The same process is also used in the manufacture of larger articles, such as sanitary porcelains and special refractory clay shapes. To facilitate this casting, deflocculating agents (which increase the "flowability" of the clay without requiring added water) are necessary. Sodium silicate, commonly called water glass, is used extensively for this purpose. However, there is a wide range of compositions in water glass and variations in composition may produce quite different effects on the rate of flow of the clay slip. An investigation of the effects of these variations in composition has been recently completed at the Columbus (Ohio) station of the bureau.

The data obtained seem to justify the following conclusions:

1. Sodium silicates low in soda and high in silica between the ratios of 1:33 to 1:4 are the most effective deflocculating agents for a given Na_2O content. It must be remembered that this type of silicate contains a large amount of water and, therefore, it may be necessary to add more of the solution than of the other silicate solutions to introduce the same amount of Na_2O.

2. For the clays of this investigation, minimum viscosity occurred while the slip was acid (pH value less than 7).

3. Silica sol (SiO_2) used alone is not a deflocculating agent.

SPECIFICATION FOR VITRIFIED CHINAWARE REVISED

The United States Government Master Specification for Vitrified Chinaware No. 121, adopted November 5, 1924, has been revised and issued as No. 121a, dated September 25, 1926.

The revision of the specification was necessitated chiefly by the fact that some of the tests prescribed were apparently too rigid, and also by the requirements of the various branches of the Federal Government for shapes of ware not included in the original specification.

The revision was thoroughly discussed and approved at a conference between the American Vitrified China Manufacturers' Association and the Federal Specifications Board's technical committee on chinaware which was held at the bureau on May 11, 1926. The most significant changes were: (1) The elimination of all minimum (or maximum) values on any single piece, the evaluation being based on averages alone; (2) the elimination of the quenching test; and (3) a reduction in certain impact and chipping values and an increase in others. Some changes in wording were also made to clarify certain statements of questionable meaning, and four new shapes were added.

The revised specification covers 71 different items in three weights, viz, thick china, hotel (rolled edge) china, and medium-weight china. It contains an itemized list giving the name, trade size, actual size, tolerances in size, maximum weight, and sectional drawings of each piece. It also specifies the maximum absorption allowed and the minimum resistance to impact, chipping, and quenching. The apparatus used and the methods of making the physical tests are described in detail.

Copies of this specification may be obtained without charge from the Federal Specifications Board, Bureau of Standards, Washington, D. C.

ANALYSIS OF HYDRATED LIME BY A THERMOCHEMICAL METHOD

In the course of an investigation recently conducted at the bureau on the rate of carbonation of lime plaster it was found necessary to develop a method of analysis by which some information could be determined which was not given by the ordinary chemical analysis. It was desired, in order to compare intelligently magnesian and high calcium hydrated limes, to be able to determine the actual percentages of calcium oxide and magnesium oxide combined, either as carbonates or as hydroxides. By this means the relative rates at which calcium and magnesian limes hydrated and carbonated when used as mortars or plasters could be better determined.

The method found most satisfactory is, in brief, as follows: A sample of the material in question, either hydrated lime, mortar, or similar material, is heated at succeeding temperatures for definite periods of time. The loss in weight is determined after each heating, and from the data thus obtained a curve is plotted, temperature against loss in weight. Definite breaks occur in this curve, indicating the dissociation of the magnesium hydroxide, calcium hydroxide, and calcium carbonate, and from the curve the loss in weight due to the decomposition of each of these compounds individually may be obtained. From these data the percentages of the compounds may be readily calculated. It has not been found possible to differentiate magnesium carbonate from calcium hydroxide by this method since the temperature range in which they decompose is too narrow. The method does, however, give good results for calcium hydroxide and magnesium hydroxide, and it is probable that when relatively small percentages of carbon dioxide are present this constituent occurs almost entirely as calcium carbonate.

A considerable number of samples of commercial magnesian hydrated limes have been investigated by this method. It was found, in general, that samples freshly made contained very little magnesium hydroxide, but that the calcium oxide content was practically completely combined. This may in part be due to the actual slowness of the hydration of

the magnesia, and also to the practice commonly followed in hydrating quicklime, of adding only enough wtaer to satisfy the chemical requirements of the calcium oxide, and entirely neglecting the magnesium oxide. Samples which had stood in the laboratory for some time were found to be considerably ing that in time this does hydrate, and higher in magnesium hydroxide, showindicating that, perhaps, improved methods might be devised by which the magnesia might be more completely hydrated at the start.

MEASUREMENT OF THE WORKABILITY OF CONCRETE

A study of the workability of concrete mixtures is being carried out at the bureau under a cooperative research arrangement with the Celite Products Co., Los Angeles, Calif. The purpose of this work is to devise an apparatus which will measure accurately that quality of concrete known as workability and to obtain this measurement in units which are used in engineering work.

Several years ago a penetration apparatus was developed in the cement section of the bureau for the measurement of workability. The apparatus consisted of a 6 by 12 inch cylindrical mold mounted upon a small table which can be raised or dropped about one-tenth inch by means of a cam. A spider carrying a sleeve is mounted on the top of the mold. Through the sleeve a close-fitting rod is introduced in alignment with the axis of the mold.

The batch of concrete to be tested is placed uniformly in the mold and first compacted by 30 drops of the table, then the rod is inserted in the sleeve and lowered gently into the concrete until it comes to rest under its own weight. The cam shaft is then turned and the mold full of concrete is successively raised and dropped in such a manner as to allow a reading of the penetration of the rod after each impact. The test was regarded as completed when the rod had penetrated the concrete 10 inches.

As the same means were used for driving the rod through the mass as were used for compacting it, the test was not reliable for the lean and harsh working mixtures. To overcome this objection and to secure more exact measurements on all mixtures a new method has been devised for driving the rod. The new part of the apparatus is similar to a pile driver in that a weight is released from a fixed height above the rod and falling free drives the rod through the concrete without further raising and lowering of the table, once the concrete is uniformly compacted. The workability is measured by the reciprocal of the work in causing the penetration of the rod.

Tests have been made on concretes of different proportions from 1:1½:3 to 1:3:6 in which the amount of water was varied to give consistencies from a very dry mix to a wet mix. The data so far obtained showed the difference in consistency quite markedly. First the dry mix requires the most work, then by adding more water the concrete becomes more workable, until a point is reached where too much water has been added, causing segregation, and the workability is again decreased. In order to confirm this preliminary study further tests are being carried out and additional studies are being made in which a body of compacted concrete is deformed instead of a displacement of a part of the mass, as is done in the penetration apparatus.

After a method of measuring workability is full developed, it is planned to test a wide range of concrete mixtures in which other qualities will be determined, and the relation between them and workability will be studied.

EFFECTS OF COMPOSITION ON THE PROPERTIES OF GROUND COAT ENAMELS FOR SHEET STEEL

The present commercial vitreous enamels for sheet iron and steel, used in the production of enameled kitchen ware and similar articles, are very limited in types of composition. Fundamental researches conducted at the bureau and elsewhere have developed valuable in-

formation for the industry, but the application of the findings has been hindered by the limitations of present compositions. In an effort to relieve this situation the bureau has studied new fields of ground coats and cover coats, and a report on the cover coats was published in Technical News Bulletin No. 104, December, 1925.

In the work on ground coats a series of compositions was planned about each of three refractory bases, one of which and feldspar, another consisting of feldspar only, and the third of flint only. A fixed minimum of metallic oxides, boric oxide, and sodium oxide was used throughout. The variable portion in each series was made up of equal parts of three constituents, chosen from a total of six in such a way that every possible combination was employed. These six constituents were boric oxide, sodium oxide, cryolite, fluorspar, lead oxide, and zinc oxide. The ground coats were applied to 8-inch dinner plates, covered with two coats of a standard white enamel, and tested for resistance to mechanical and thermal shock.

Analysis of the data indicated the existence of several rather clear-cut general relationships, as follows:

1. A high feldspar content in ground coats, produced by replacing the customary flint content with feldspar, greatly decreased resistance to mechanical and thermal shock.

2. A high flint content in ground coats, produced by replacing the usual feldspar content with flint, improved the resistance to mechanical shock.

3. Of the six variable constituents studied, a high sodium oxide content in ground coats was outstandingly conducive to a high resistance to both mechanical and thermal shock.

4. A high boric oxide content increased resistance to mechanical shock.

5. Expansivity of the ground coats did not appear to be as powerful a factor in its effect upon resistance to mechanical and thermal shock as it has been proven to be in its effect upon fishscaling.

SOIL CORROSION TESTS

About 1,500 of the specimens recently removed in the Bureau of Standards soil-corrosion tests are now available for examination at the bureau. These include various kinds of iron and steel pipe, galvanized sheet and pipe, and asphalt and pitch protective coatings. The data on losses of weight, depth of pits, etc., will not be available before January 1, 1927.

ROUGH TURNING WITH PARTICULAR REFERENCE TO THE STEEL CUT

The discovery by Frederick W. Taylor, some 20 years ago, of so-called high-speed tool steels is recognized as one of the greatest contributions to the art of cutting metals and an important factor in the development of modern methods of mass production in the machine shop. With the discovery of high-speed tool steels Taylor worked out the laws of cutting in rough turning carbon steels representing the types then industrially machined. Many of these relations have since been checked, but so far no extended investigations have been carried out in cutting the alloy steels of high tensile strength which are now so widely used in structural work.

Some tests have been made recently by the bureau primarily to extend to current commercial alloy steels some of the empirical laws originally worked out by Taylor in cutting carbon steels. The steels cut included some carbon, nickel, low and high chromium, chromium-vanadium, chromium-molybdenum, and nickel-chromium steels having tensile strengths between about 65,000 and 195,000 lbs./in.^{2} The effect of variation in chemical composition and mechanical properties of the metal cut on tool life, cutting speed, and the power required in cutting was determined for the current high tungsten-low vanadium, low tungsten-high vanadium, and so-called cobalt high-speed steels now on the American market. In addition, a study was made of the effect upon tool life of cutting speed, feed, depth of cut, coolant, etc.

Certain measurable differences in "machinability" in rough turning were found for the different alloy steels, but in most cases these were no greater than differences in tool performance arising from the "quality" and heat treatment of the steels from which the tools were made. In general, however, when comparisons were made at low tensile strengths, plain carbon steels and steels containing 3½ per cent of nickel were more "machinable" in rough turning than steels containing similar carbon content and 1 per cent or more of chromium, with or without other elements. At high tensile strengths, in the neighborhood of 175,000 to 190,000 lbs./in.^{2} the order of "machinability" was often reversed and chromium-molybdenum and nickel-chromium steels permitted longer tool life, under comparable conditions, than 3½ per cent nickel or chromium-vanadium steels. The latter, in particular, fell off rapidly in "machinability" with increase in hardness or tensile strength.

Tests with various liquids showed that the modern high-speed steels do not gain as much in performance by the use of coolants as the original high-speed steels developed by Taylor. Of the liquids tried, water was most effective in promoting tool life, oil-water emulsions next, and lard oil the least effective.

INTENSITY AND DURATION OF FIRES IN BUILDINGS

One of the tests to obtain information on the intensity and duration of fires in buildings which the bureau has conducted was described in Technical News Bulletin No. 68, December, 1922. The object of these tests is to determine the temperatures to which it is proper to subject building materials and constructions in fire-test furnaces and to serve as a guide in applying the results of such furnace tests to building design. In the test furnaces walls, partitions, floors, doors, and windows are subjected to a controlled test fire reaching certain intensities at given times after the start of the test, the result being expressed in a time-endurance unit or period which is the length of time the construction withstands the test fire without failure or dangerous weakness. The burning-out tests give information relative to the propriety of the fire intensities employed in the test furnaces and indicate for what building types and occupancies constructions are adequate that have withstood the regular fire tests for given periods.

On September 16 a test was carried out in the bureau's new test structure, fitted up to simulate a record storage or reference room, an occupancy which is considered as creating the severest fires in office buildings. The combustible contents, consisting of wood shelving, furniture, and records, amounted to about 44 tons for the whole building, which is 30 by 60 feet in inside dimensions, or about 49 lbs./ft.^{2} of floor area. The records were old account records of the Navy Department. The furniture was obsolete and useless materials turned in to the General Supply Committee. The fire was started in a waste-paper basket in one end and allowed to build up and progress to all parts of the room. The shutters in one end and one side of the building, as also in the roof monitor, were opened gradually to admit the proper amount of air for maximum fire conditions, and were left at the maximum opening attained while the interior cooled down. The temperatures were measured by means of thermocouples at over 100 points within the building and in the débris, readings being taken every five minutes at each point. These tell the story of the fire, how it progressed through the room and how it built up and died down at the different locations. Considering the building as divided into thirds along its length, in the east third, where the fire started, maximum temperatures of from 1,350 to 1,650° F. were attained in 40 minutes to 1½ hours after the start of the fire. In the middle third, temperatures of from 1,580 to 1,780° F. were attained in 1 hour 40 minutes to

2 hours, and in the last third the maximum readings were from 1,700 to 1,770° F., reached in 3½ to 5 hours.

Four burning-out tests have previously been conducted in the small building, 16 by 30 feet in laterial dimensions, that was used in the present test to house the observers taking the temperature readings. In three of the tests it was fitted with desks, files, and other combustible materials weighing about 13 lbs./ft.^{2} of floor area. In two of these tests a wood-top floor was present and in the other a cement-finished floor. In two of the tests the fire was given a quick start by burning a large amount of readily combustible materials in one corner until the temperature all over the room was near the ignition point, this representing conditions where a fire breaks into a room or building from an adjoining burning room or building. In the third test the fire was given a slow start from a fire in a waste-paper basket, as in the present test. A fourth test was also conducted in the smaller building with a record-room occupancy similar to that in the present test, except that the concentration of combustible materials was a little heavier, being 58½ lbs./ft.^{2} of floor area. This produced a fire of much greater intensity and duration than in the first three tests with regular office occupancy. The test was repeated in the present larger structure in order to obtain whatever effects might be caused by the larger room size. The room dimensions in the latest test, 30 by 60 feet, are deemed to have taken care of this factor. This building will later be burnt out with a regular office occupancy with wood furniture, as in the three tests in the smaller structure. The latter will then be fitted with metal furniture and attempts will be made to burn it out, using both slow and exposure starts for the fire. This will conclude the work with office occupancy.

Further tests are intended with residential and warehouse occupancies in order to cover the range of conditions encountered in connection with fires in buildings.

SEPTEMBER, 1926, PUBLICATIONS

Additions to "Supplementary List of Publications of the Bureau of Standards" (Beginning July 1, 1925)

Scientific Papers[1]

S530. Establishment of radio standards of frequency by the use of a harmonic amplifier; C. B. Jolliffe and Grace Hazen. Price, 10 cents.

S531. A principle governing the distribution of current in systems of linear conductors; F. Wenner. Price, 10 cents.

S532. Analysis of dental gold alloys; William H. Swanger. Price, 10 cents.

Technologic Papers[1]

T319. Holding power of wood screws; I. J. Fairchild. Price, 15 cents.

T320. A fabric tension meter for use on aircraft; L. B. Tuckerman, G. H. Keulegan, and H. N. Eaton. Price, 10 cents.

T321. A study of sieve specifications; Lewis V. Judson. Price, 5 cents.

T322. Effect of dry cleaning on silks; M. H. Goldman, C. C. Hubbard, and Charles W. Schoffstall. Price, 15 cents.

Simplified Practice Recommendation[1] (Elimination of Waste)

R50. Bank checks, notes, drafts, and similar instruments. Price, 5 cents.

Handbook

H9. Safety rules for radio installations. Price, 10 cents.

Technical News Bulletin[2]

TNB113. Technical News Bulletin, September, 1926.

OUTSIDE PUBLICATIONS

The computation of colorimetric purity. Deane B. Judd; Journal, Optical Society of American and Review of Scientific Instruments, vol. 13, No. 2, August, 1926.

The computation of colorimetric purity II. Irwin G. Priest; Journal, Optical Society of American and Review of Scientific Instruments, vol. 13, No. 2, August, 1926.

A photo-ionization experiment with hydrogen. F. L. Mohler; Proceedings, National Academy of Sciences, vol. 12, p. 494; 1926.

Helmholtz coils for producing uniform magnetic fields. Arthur E. Ruark and Melville F. Peters; Journal, Optical Society of American and Review of Scientific Instruments, vol. 13, p. 205; 1926.

Long distance radio receiving measurements and atmospheric disturbances at the Bureau of Standards in 1925. L. W. Austin; Journal, Washington Academy of Sciences, vol. 16, No. 14, p. 398; August 19, 1926.

Progress report on the dental casting process. R. L. Coleman (Research Associate); The Dental Cosmos, vol. LXVIII, No. 8, p. 743; August, 1926.

Government cooperates in research. H. W. Gillett; Iron Age, vol. 118, p. 673; September 9, 1926.

Metals to resist corrosion or high temperatures. H. J. French; American Electrochemical Society, Preprint, No. 5, September, 1926.

Refractories for melting pure metals—iron, nickel, platinum, L. Jordan, A. A. Peterson, and L. H. Phelps; American Electrochemical Society, Preprint, No. 8; September, 1926.

Silicon as an alloy in steel. H. W. Gillett; Metallurgical Industry (London), vol. 29, p. 248; 1926.

[1] Send orders for publications under this heading with remittance only to Superintendent of Documents, Government Printing Office, Washington, D. C. "Outside publications" are not for distribution or sale.

[2] Subscription to Technical News Bulletin, 25 cents per year (U. S.); 40 cents (foreign).

Discussion on specifications and requirements for common brick. C. O. Christenson; Clay Worker, vol. 86, No. 3, p. 197; September, 1926. (Republished article from American Architect, vol. 80, No. 2500, p. 23; July 5, 1926.)

Bureau of Standards investigations of pottery, heavy clay products, glass, and enamels. Ceramic's division staff; The Ceramist, vol. 8, No. 5, p. 285; August, 1926.

Progress report on investigation of sagger clays. R. F. Geller and R. A. Heindl; Journal, American Ceramic Society, vol. 9, No. 9, p. 555; September, 1926.

Some advances in gypsum technology. J. M. Porter; Chemical and Metallurgical Engineering, vol. 33, No. 9, p. 549; September, 1926.

Rayon research at the Bureau of Standards. Charles W. Schoffstall; Daily News Record, September 23, 1926.

Konsistenzmessungen von Gummi-Benzollösungen. W. H. Herschel and Ronald Bulkley; Kolloid-Zeitschrift, vol. XXXIX, No. 4, p. 291; August, 1926.

Housing standards. John M. Gries and James S. Taylor; The Small Home, June, 1926.

Need for greater uniformity in building codes. John M. Gries; National Real Estate Journal, July 26, 1926, and Annals of Real Estate Practice, 1926.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1926